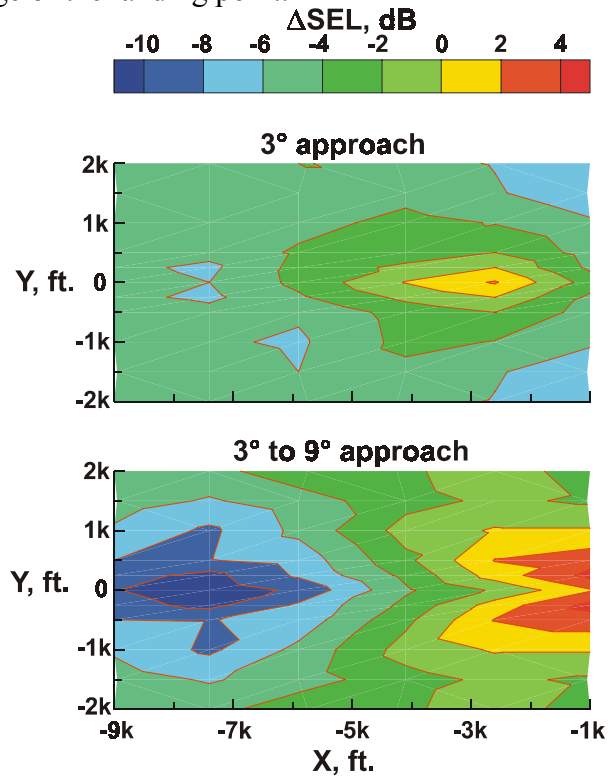


NASA Langley Research Center

Contacts: (see specific sections)

Tiltrotor Terminal Area Flight Procedures

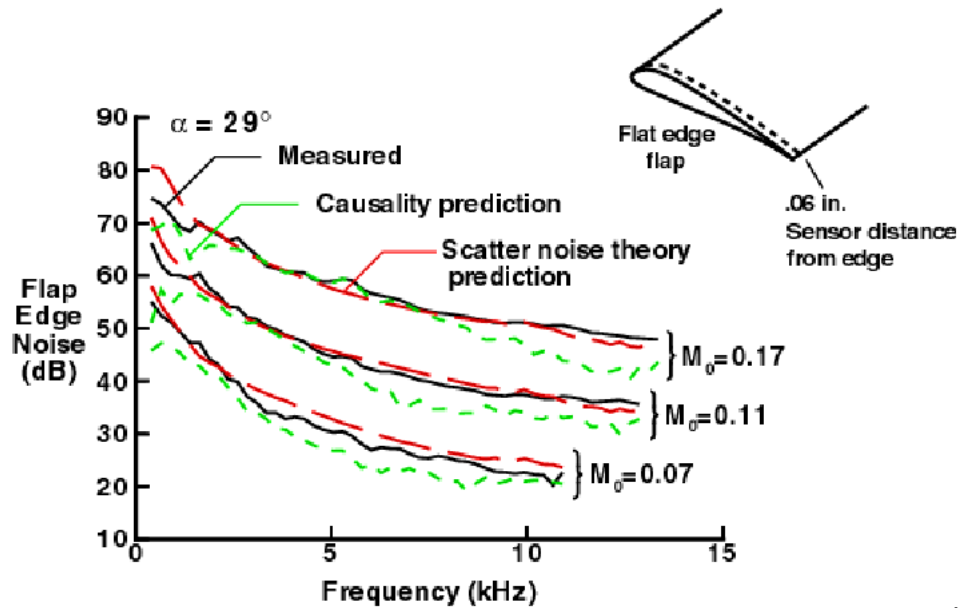
The third in a series of three XV-15 low noise terminal area operations flight tests was conducted in October 1999, at Waxahachie, TX, by the NASA/Army/Bell Helicopter test team. The purpose of the flight test program was to develop safe, low noise terminal area flight procedures for tiltrotor aircraft by optimizing the nacelle angle, airspeed, and glide slope schedules to reduce the noise footprint while fully coupling handling qualities requirements with noise reduction. The microphone array consisted of 37 ground board mounted microphones that were deployed over a 367-acre area. Compared to the “baseline” 6° approach, the 3° approach provided a relatively uniform noise reduction of 4 to 6 SELdB over most of the measurement area while a 3° to 9° segmented approach profile provided more than 10 SELdB noise reduction near the centerline, between 6000 and 9000 feet up-range of the landing point.



NASA Langley Contact: David A. Conner (d.a.conner@larc.nasa.gov)

Airframe Noise Studies

Airframe Noise studies in NASA Langley's Quiet Flow Facility (QFF) provides validation that shear layer instability and related pressure scatter is the dominant flap-edge noise mechanism. The figure shows that measured flap -edge noise compares well with scatter noise theory predictions and causality-based predictions, using unsteady surface pressure sensor results at the flap edge.



The results were presented at the 6th AIAA/CEAS Aeroacoustics Conference as Paper No. 2000-1975.

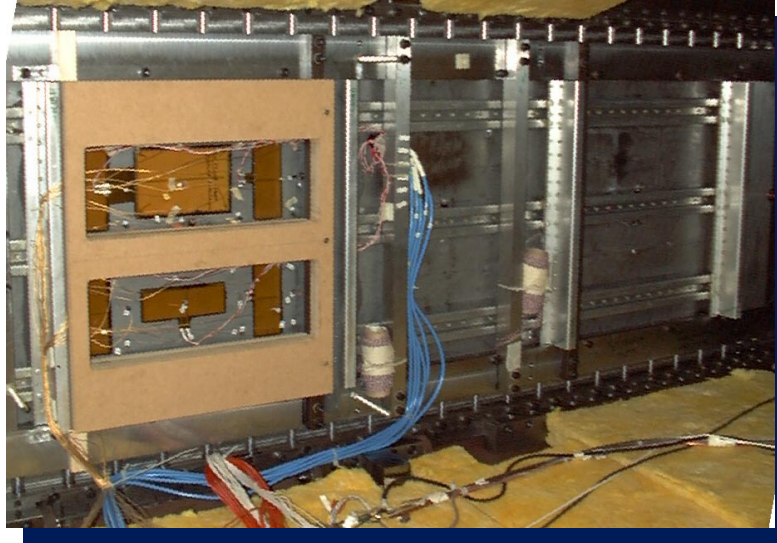
NASA Langley Contact: Tom Brooks (t.f.brooks@larc.nasa.gov)

Structural Acoustic Control System

NASA, Virginia Tech and Raytheon engineers have successfully demonstrated a second generation active structural acoustic control system employing a principal component based real time controller and optimized transducer locations on a Raytheon 1900D commuter aircraft. Reductions of 14 dB on the BPF and 3-5 dB on the higher harmonics were attained in flight.



Active control system tested on Raytheon Beech 1900D aircraft



Aircraft panel installed in AEDC von Karman Tunnel A.

Engineers at NASA Langley have reduced the transducer requirements for active structural acoustic control of turbulent boundary layer noise on realistic aircraft panels to a single sensor input and a single piezoceramic actuator while maintaining effective broadband control. Previous results in an AEDC wind tunnel at Mach 0.8 and 2.5 reduced total radiated sound 10-15 dB at resonances and 5-10dB over 150-800 Hz.

NASA Langley Contact: Richard Silcox (r.j.silcox@larc.nasa.gov)

Ducted Fan Noise Prediction Code

The Langley ducted fan noise prediction code TBIEM3D based on the boundary integral equation method (BIEM) has been added two new capabilities. The flow Mach number inside the duct can be different from the flight Mach number. In addition, the noise from a ducted fan having a co-annular duct with segmented liner can be predicted. The code calculates the noise from rotating dipoles inside a finite and infinitely thin circular duct in uniform forward flight. The duct propagation and radiation are treated in a unified manner using BIEM without the need of the knowledge of the inlet and exhaust impedances.

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Nacelle Liner Impedance

In-situ control of nacelle liner impedance is an attractive possibility, both for liner developmental testing and eventually for in-flight applications. Work at Boeing, Georgia Tech, and NASA Langley Research Center (LaRC) have focused on understanding bias flow as a means of effecting in-situ liner impedance changes. These efforts have generated mixed results. Purely experimental efforts at Boeing showed no significant impedance change due to bias flow, yet a Georgia Tech experiment showed significant improvement in normal incidence absorption with the aid of bias flow. Work conducted by Virginia Consortium of Engineering and Science Universities (VCES) at LaRC focused on the collection of a quality database of impedance data for a range of perforates

with open area ratios ranging from 0.05 to 0.12. This database was used to determine the relative performance of various perforate impedance models, and to demonstrate that including bias flow in the design of an optimized two-layer passive liner provides improved broadband normal incidence acoustic absorption.

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Noise Abatement Procedures

The highly instrumented NASA LaRC 757 research aircraft was used to fly an assortment of approach and departure procedures over an array of ground based microphones. The purpose was to quantify, under controlled and recorded circumstances, noise benefits resulting from advanced noise abatement procedures which can be flown by current jet transport aircraft using existing avionics equipment.

Both departure and approach procedures were flown over microphone arrays located beneath the aircraft flight trajectory. Baseline procedures for both the departure and approach scenarios were established using Boeing operational recommendations. Variations of both the departure and approach scenarios were then flown over the same arrays. A database containing the far field acoustics measured from each procedure has been constructed. The resulting acoustics database is time correlated with databases for 1) the positions of aircraft controls, control surfaces, and engine parameters, 2) differential GPS aircraft tracking, and 3) weather conditions for each flight test procedure. The differential GPS was used in real time to determine that the planned aircraft trajectory was achieved and a third person was stationed in the jump seat of the aircraft cockpit to insure that the various procedures had been properly executed.

The flight test was run in April 2000 at the Airborne Airpark airport facility in Wilmington, Ohio. This airport facility can support large jet aircraft, has a low air traffic volume during daylight hours and hence, has a relatively low noise background during the needed operational hours.

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Jet Noise Database

A large database of noise from ultra-high bypass ratio co-annular jets was collected using the Jet Engine Simulator in the Low Speed Aeroacoustic Wind Tunnel at NASA Langley. The directional data included bypass ratios up to 14, forward flight simulation up to Mach 0.28, and generic cycle lines representative of conditions from takeoff to cutback. In addition to test points along the cycle lines, parametric variations off the line were taken. The data is being used to extend an existing semi-empirical, dual-flow jet noise prediction code to higher bypass ratios.

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